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Abstract

[Back to Hit List](#)**Grant Number:** 1Z01NS002986-01**PI Name:** DIAMOND, JEFFREY S.**PI Email:****PI Title:****Project Title:** DYNAMICS OF EXCITATORY SYNAPTIC TRANSMISSION IN THE CNS

Abstract: The brain stores information in patterns of synaptic connections within large networks of neurons. New information is incorporated into a neural network through the modification of connections via mechanisms that are incompletely understood. One fundamental question is whether individual connections behave independently, or whether they are influenced by the activity of neighboring synapses. Synaptic connections are made through the release of diffusible neurotransmitter molecules that bind to receptors on the recipient neuron; recent evidence suggests that the neurotransmitter may escape the synapse in which it is released and diffuse into neighboring synapses. This "spillover" of neurotransmitter between synaptic connections would have a profound impact on the information capacity of neural networks and the mechanisms by which they are constructed during development. Work in this laboratory is directed towards determining whether the excitatory neurotransmitter glutamate spills over between synapses in the hippocampus, a major site of learning and memory storage in the brain, and in the retina, where visual stimuli is encoded for transmission along the optic nerve. Using electrophysiological techniques in acutely prepared slices of rat retina and hippocampus, we have found that glutamate escapes the synapse from which it is released and diffuses into neighboring synapses. This diffusion is tightly regulated by glutamate transporters, pump proteins located primarily on glial membranes that bind glutamate and remove it from the cerebrospinal fluid. Moreover, it appears that the electrical state of the recipient neuron influence whether the receptors are responsive to low levels of glutamate released from a distant synapse. Work is continuing to investigate the modulation of these mechanisms and their impact on information processing in networks of neurons.

Thesaurus Terms:glutamate, hippocampus, neural transmission, retina, synapse
diffusion

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